

BOOK REVIEW

Citrus Pests and their natural enemies; integrated pest management in Australia. Smith, D., Beattie, G.A.C. and Broadley, R. (Eds). Queensland Department of Primary Industries and Horticultural Research & Development Corporation; 1997; 272 pp. ISBN 0 7242 6695 X. Price \$75.

This superbly compiled book amply validates Bertrand Russell's description of science as "common-sense writ large". It will be an essential and invaluable reference for anybody who grows citrus or is interested in citrus entomology. It should also be essential reading for anybody interested in IPM, to learn what can be achieved in a complex crop system with patience and dedication, and for lessons in the compilation of an IPM manual. The book should also appeal to those interested in natural enemies and the natural control of insect populations.

The book starts with a 3-page glossary of 'technical' terms, a brief description of citrus varieties and citrus orchard management, a useful table of annual climatic data for Australian citrus districts and a description of diseases, physical blemishes and physiological disorders of fruit (with accompanying colour plates).

The "concepts and advantages of IPM" (chapter 2) highlights the need for identification of pests and natural enemies, the monitoring of pests and natural enemies, 'action level' (the point at which action must be taken to avoid economically significant crop or tree damage by the pest) and 'appropriate action'. It usefully opines that action levels are simply "estimates based on research and experience... and will vary according to citrus variety, district, market price and demand. Growers and pest scouts can adjust the action level as necessary and according to their experience of the particular orchard and environment."

The next 21 chapters, of 174 pages, give "detailed information on the insect, mite, spider, nematode and snail pests which attack citrus." Descriptions are given of each pest, of the damage it causes, of its biology and life-cycle, of its parasitoids (parasites) and predators, of its pathogens and of its management. For each pest, a distribution map of Australia shows the main areas (in colours) where it is a major pest, a minor pest and an occasionally important pest. The text is right up to date, with the inclusion of the papaya fruit-fly. The index gives both common names and scientific names of pests and natural enemies.

As is usual in IPM manuals today, the descriptions are accompanied by more than 400 magnificent colour plates which should allow easy recognition of most of the pests and the larger natural enemies. The small to very small parasites need to be identified, of course, with a microscope or a powerful hand-lens. An appendix describes how such parasites can be mounted on slides for microscopic examination and it gives a key for identifying common wasp parasites of scales and mealybugs. The key contains none of the usual morphological mystery. For every alternative statement in each couplet there is a clearly drawn and labelled diagram illustrating the morphological point(s)! Why cannot *all* taxonomic keys be so illustrated?

The 'management' section for each pest includes 'monitoring' (when and how), 'action levels', 'appropriate action' which outlines different management strategies and 'additional management notes'. The extensive and sensible information on monitoring and action levels helps to make this the most useful manual on IPM I have read. I found the notes on monitoring especially clear because they distinguish between a sample and a sample unit, as in mathematical texts on sampling. Thus,

"the parts of the trees that are sampled are called 'units'. A unit may be a fruit, a group of leaves, a shoot, etc. In a block where the sample size is 15 trees, 75 individual units of each type may be assessed on each monitoring date, i.e. 5 sample units from each tree." I also particularly liked the 'action level' to sometimes depend on the predator-pest or parasite-pest ratio. The frequency of use of such ratios in IPM should increase as we learn more about crop systems. Such ratios could also serve as testable hypotheses for the academic study of plant-predator-prey interactions - and could keep a whole generation of post-graduate students busy.

The list of good points about the book continues. Chapter 24 gives a list of the important parasites and predators attacking citrus pests in Australia. Chapter 25 clearly spells out the techniques of IPM used in citrus. It also describes how sample data can be recorded in the field and how they can be converted to spreadsheets and computer graphs. A monitoring guide to the pests expected in early season, mid-season and late season in different parts of Australia is further illustrated with excellent colour plates. Chapter 26 gives a useful account of the advantages, disadvantages and set-up procedures for various kinds of orchard sprayers. Chapter 27 describes the compositions and proper use of petroleum spray oils and their effects on many of the pests. The final chapter gives a useful table, for each of 42 pesticides, of its toxicity to natural enemies and of the suggested waiting time, in weeks, before introducing beneficial insects to the orchard after its use.

The text is always clear and well written and a few small blemishes do not detract from the high quality of the book. One blemish is that none of the colour plates has a magnification noted. This does not matter for most of the pests because the size is given in the text, but the sizes of the predators are not so given and not all of them are portrayed with a pest whose size can be used for comparison. Thus, plates 5.4 and 5.6 suggest that the adults of brown and green lacewings are of the same size. And how big, really, are assassin bugs (plates 12.9, 12.10)?

Another blemish is that much of the information about *predators* is patchy so that a non-entomologist would probably not be able to easily distinguish between brown lacewings and green lacewings from the information given in the book. This problem could have been resolved and a lot of repetition about natural enemies could have been avoided, by having an early chapter, say chapter 3, on the biology of natural enemies. There it could also have been said, *once*, that endoparasitic wasps laid eggs *inside* their hosts, but that parasitic flies always laid their eggs *on* the host.

A useful addition to the book would have been the addresses of companies which supply beneficial insects and a list of the species available from each company.

The book is A4 size and is printed on good quality glossy paper. It was produced by the major agricultural organizations in each of the mainland states, the HRDC and the University of Western Sydney, "working in partnership and with contributions and support from the citrus growers of Australia and from many people involved in integrated pest management" - 24 of whom are listed as 'the authors'. The citrus growers and the institutions should be well pleased with the result. The 'authors' and the editors deserve high praise. The book is highly recommended.

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